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A

LETTER

TO

PROFESSOR STEWART,

ON THE

OBJECTS OF GENERAL TERMS,

AND ON THE

AXIOMATICAL LAWS OF VISION.

SECOND EDITION,

TO WHICH ARE HERE ADDED,

SOME REMARKS ON THE MONTHLY REVIEW ON THIS SUBJECT.

BY J. FEARN, ESQ.

London :

1818.

TO

DUGALD STEWART, ESQ.

F. R. SS. LOND. AND EDIN. &c. &c. &c.

FORMERLY PROFESSOR OF MORAL PHILOSOPHY IN THE
UNIVERSITY OF EDINBURGH.

SIR,

In presenting a view of the two following subjects, each of which has occupied the attention and urged the genius of thinking men, to a great and celebrated extent, I am impelled by reasons of no ordinary complexion : And, while it is to be expected that the topic which stands *first* subjoined, may, in the outset, interest a more numerous class of literary persons, I am highly urged to solicit the important issue of your earnest notice of that one which is placed *LAST*. The former subject, however, besides its own importance, has a certain bearing upon the latter, although it be not obvious here.

The matter of the “ LAWS OF VISION,” to which I here attach the greater interest, is presented as exhibiting what I (who certainly speak under strong inducements to caution) am obliged, by the nature of the thing, to consider *a mathematical analysis* of the *constituents, or cause, of VISIBLE FIGURE*. This, I apprehend, it must be considered ; since the *FOUR LAWS OF VISION are not physical laws merely*, but are also *FOUR AXIOMS*, whose truth consequently is *necessary*, and whose *NATURE is certainly mathematical*. Fully anticipating, as I do, the first impression of so extraordinary a matter, and sensible of the utility of some sort of passport, in my peculiar case ; may I therefore be permitted to offer the following observations ?

When, about two years since, I ventured to publish a few copies of the “ *Principles of Primary Vision*,” (the *first* hint concerning which, appeared about *four* years back) I had indeed a confident hope that I should have to repeat the subject : but I did not expect

so curious and valuable a support, as the discovery that I am completely borne out by the rigorous assumption of an illustrious Greek Geometer. Such, however, is an authority which, owing to a recent communication, I am enabled to cite, and therefore purpose to bring forward here; not, however, without the additional concurrence of living individuals; which, together, form a very different voucher from my own very questionable judgment, as to whether this matter is what I conceive it to be.

Valuing, as I must do, the concurrent authority of PROCLUS, thus made known to me; I rest no undue confidence either upon his, or upon any other single voice. In the present case, indeed, the *imperative nature of the evidence* looks down upon single suffrage: but, since even mathematical propositions must bow to *collective suffrage*, I derive no small resolve from being able to pledge myself here, that among the acute and scientific individuals to whom the matter has been personally communicated, there has occurred but one dissent, (*limited to inessentials*) and that one has not survived discussion. The principal value, therefore, which I attach to the *concurrence* of PROCLUS is, that I feel no reluctance in making an open use of it, for the advancement of the subject.

While I am naming that Geometer, it may be of material consequence to state, that although the fact assumed by him attests the truth of the Laws of Vision, yet *these Laws have no dependance whatever on that fact*. But of this I must speak hereafter. May I however add, that Proclus has not handed down his *proofs*; but that the fact itself was fallen upon by me, I need not say, without any knowledge that another had gone before. Indeed, that this fact, known to *Proclus*, was completely *lost to the moderns*, AS TO ANY UTILITY, is fully manifest from its not being noticed by any one of those who have engaged on the great problem, to *find the NATURE and PLACE of visible figure*.

Of authorities, ancient and modern, who have ASSERTED the *dominion of SENSE over the ELEMENTARY objects of GEOMETRY*, there is a numerous host; and these are of the highest estimation: only they have *all failed to prove* their assumption by *showing the PRECISE MANNER, HOW the elements of visible figure are* either connected, or formed. PROCLUS alone (seconded by Barrow), is *partly* an exception, in having noted *one included or subordinate fact*; which, however, never led him to the *FOUR AXIOMS OF VISION*, nor to the *PLACE of perceived figure*.

Such, Sir, is the prospect of this matter: while, either from the

* Since this was first printed, I have found the matter is further backed by a slight but unequivocal allusion of DR. BARROW, fully recognising the *same fact* that is assumed by PROCLUS: although neither of these writers deduce from it any *consequences* in philosophy.

want of some such passport as the foregoing, or from my own culpable remissness in not caring to urge the matter through the ordinary channels, or from some other cause, I am obliged to believe it cannot have reached your eye, or undergone the sentence of your judgment. Unquestionably I am bound to my contemporaries and to the future race, to place this matter in the direct channel of your notice, since the command to do so has fallen thus imperatively upon me.

Beside the AXIOMS OF VISION, *themselves*, let me now beg to suggest to notice, their very remarkable agreement with that astonishing metaphysical tenet of the HINDOOS, which makes "*the whole of creation rather an energy than a work, by which the infinite mind, who is present at all times, and in all places, exhibits to his creatures a set of perceptions, like a wonderful picture, or piece of music, always varied, yet always uniform.*"

Upon the bare mention of this (I had almost said, divine) HINDOO TENET, it appears to me unavoidable to remark, that, if it can strictly be said that it "took its rise from a high theological speculation," it must have been *indeed* a *HIGH* one; since the most luminous results of modern physical research have but led, by a slow and groping progress, toward this solar light of HINDOO PHILOSOPHY.—Can any person without astonishment contemplate such a coincidence of results, meeting from so very distant sources, and flowing through such different channels?

The mind is rapt and lost in attempting to conjecture at what time, under what circumstances, and by what guidance, the early generations of our species were enabled to perfect a philosophy of such a flight, that the living spectator, of the highest cast, must feel shrunk in his intellectual dimensions on the comparison,—a philosophy which teaches the moderns, at once to appreciate the genius of a BERKELEY, and to stop at the line where that genius overstept upon error,—which *denies the INERTNESS of matter, without admitting such a CHIMERA as the NON-REALITY OF EXTENSION.*—Such is the EXTERNAL WORLD of *Hindoo Science*: And, (so far, therefore, as any *extrinsic coincidence* can corroborate the sentence of *internal reasoning*,) may I not set value upon the fact, that this EXTERNAL WORLD of the HINDOOS, *is to COLOR AND FIGURE in us, as we suppose EXTERNAL FIRE to be to the FIRE in a BODY which it heats?* I indeed suppose this simile is vague; but I nevertheless affirm, that the relation appears to be *as requisite and as close*, in the former case as in the latter, after we have gone through the following *analysis of the primary phenomena of vision.*

The seeming correlation of these two subjects, namely, the HINDOO EXTERNAL WORLD, and what I have felt obliged to call the "*AXIOMATICAL LAWS OF VISION,*" is the more satisfactory,

since the rays of Hindoo Knowledge that have pervaded the immense and hideous regions of their course to us, are ample evidence that its pristine laboratory shined with an effulgence not now imaginable; and prove, that a day of science has once passed over the earth, whose fellow is yet but dawning upon mankind.

In fine, Sir, it cannot be unwelcome here to mark the direct bearing of these united results *upon all the conclusions of ATHEISM!*—What a transition, from sublime admiration, to pity and debase-ment, does the mind suffer on turning from the HINDOO EXTERNAL WORLD, to listen to the GREEK *squabbles concerning DEAD MATTER!*—What a relief, to ascend back in contemplation, to that point where the physical speculations of a BOSCOVICH meet the metaphysical tenet of the HINDOO!—Can it be indifferent to the *philosopher*,—Can it be indifferent to the CITIZEN, to inquire whether an *Analysis of PRIMARY MENTAL Phenomena* makes A THIRD COINCIDENT upon this high point?

Here it remains only, that I have the honor to subscribe myself,

SIR,

Your most obedient servant,

London, July 31st, 1817.

JOHN FEARN.

TO THE READER.—It being requisite, for convenience, in the PAMPHLETEER, to insert in the present number only *one* of the two distinct subjects treated under the foregoing Letter, and the subject *placed last* by the author being the one *principally* alluded to in this prefatory Letter; besides the interest of its having been taken up in the *Monthly Review* for March last; it becomes essential to its being clearly and duly apprehended, to insert “*The Axiomatical Laws of Vision*” in the present number.

ON THE AXIOMATICAL LAWS OF VISION.

PREFACE.

THE most proper preface to the following subject, on the present occasion, appears to be that of introducing the *fact asserted by PROCLUS*, which has already been alluded to in the address prefixed to this publication. In stating this fact, however, it may be of no small consequence to note, very particularly, that although its truth

must attest the truth of the Laws of Vision, (which is my reason for bringing it forward here) yet if the fact could be actually disproved, this could not at all affect these Laws, since they do *not depend upon*, but *include*, the fact asserted by Proclus. Yet, nevertheless, I must add, that I believe myself to have distinctly proved the fact in question; which, it is to be remarked, is NOT PROVED *by Proclus*, but *only asserted* by him.

In Mr. Taylor's translation of the "*Commentaries of Proclus on the first book of Euclid's Elements*," Vol. I. page 125, is this passage, "We should admit the followers of Apollonius, who say, that we obtain the notion of a line when we are ordered to measure the *lengths alone*, either of ways or walls; for then we do not subjoin either breadth or bulk, but only make one distance the object of our consideration. But a line may become the object of our sensation, if we behold the divisions of *lucid places* from those which *are dark*, or survey the moon when dichotomised; for this medium has no distance with respect to latitude, but is endued with longitude, which is extended together with the light and shadow."

The perspicuity of the above *description* of this fact, is highly conclusive and valuable. But I cannot avoid remarking, how strange it appears that any philosopher who had adverted to this fact in the PARTICULAR *instances of "the divisions of LUCID PLACES, from those which ARE DARK,"* should not have intuitively discerned that the *principle* is GENERAL, UNIVERSAL, AND SOLE: which it must be, since LIGHT and contiguous SHADOW, produce in us TWO SENSATIONS OF COLORS, *with A LINE BETWEEN them*; just as is, and MUST be done by ANY OTHER two colors whatever.—His not discerning the UNIVERSALITY of the fact was the only thing that could have kept Proclus from advancing on, to discern the *Four Laws of Vision* and their *axiomata nature*, together with their *direct consequences*.

OF THE EXTERNAL CAUSE OF VISION.

1. DISTANT BODIES are NOT, *by any medium*, the GENERIC cause of Vision; since *sensations of COLORS, accompanied by FIGURES*, are as *constantly*, and as *variously*, excited by experiments of pressure upon the eye, and by other bodily affections, as they are by LIGHT *reflected from DISTANT OBJECTS*.

This general fact being duly recognised, ascertains of itself the *independence* of Vision upon external DISTANT *bodies*, and removes a very great and most pernicious stumbling-block, which has strangely been suffered to remain an obstacle to all advancement, although uniform experience has long demanded its expulsion from the subject.

2. When the optic organ is stimulated, either by light, by sen-

sible pressure, by certain bodily diseases, or by any other such impulse, the mind undergoes a set of SENSATIONS called *colors*. Such are those beautiful *phantoms* that appear to us when we look at a landscape or a rainbow. These phenomena *seem* to adhere to external distant objects, like a skin cast over them : but there is no fact upon which philosophers are more unanimous, than that they are nothing but our own SENSATIONS. It is therefore here assumed, AS A FIRST PRINCIPLE, *by universal consent*, that PHANTOMS OF COLORS are but "A SPECIES OF THOUGHT."

3. With this *only settled principle*, it has ever been one of the greatest problems in philosophy to discover the NATURE and PLACE of those *outlines*, that are seen as it were *surrounding the phantoms of colors*, and to which we give the appellation of VISIBLE FIGURE. — There now exist only two opinions concerning this matter : Perceived figures are either the real identical forms of external and distant bodies ; or, they are actually the forms of our own sensations, which, if so, do not SHOW, *but only INDICATE, some UNKNOWN EXTERNAL cause*. The highest authorities of the last century have divided upon this point : and the literary public, impressed by the untoward character of the schism, appear to consider all proof, or foundation on the subject, as a desideratum utterly hopeless. Such is the discouraging introduction to the following principles.

OF THE POSSIBLE CASES OF VISION.

All the possible cases, or accidents, of Primary Vision fall under FOUR *general Facts, or Laws*.

Each of these *Four Laws* is *also an AXIOM* : Its truth does not depend upon the *laws of NATURE*, but on the *law of THOUGHT* ; since, the moment it is apprehended, we discern that its *contrary is impossible*. This combination of a *mathematical nature* with a *physical nature*, forms the most striking and important character of the Phenomena of strict Vision.

Two of the Laws of Vision are UNFORMATIVE, either of any *figure*, or of any *element of figure*.

The other two Laws are FORMATIVE, either of some figure, or of some element of figure.

FIRST LAW. — UNFORMATIVE.

Prop. No one uniform sensation of color can ever be accompanied by a perception of any visible figure, any line, or any point.

Inst. If the eye traverse the unclouded heaven, or if it skim the surface of the sea, we shall undergo a *uniform SENSATION OF ONE COLOR* ; and here it is *self-evidently impossible* we should ever perceive any visible figure, any line, or any point, so long as the sight keep within the field of *this one color*.

It is plainly as impossible to conceive a visible line, without calling up *some* SECOND color, as it is to conceive a boundary to an infinite surface: For, any color we perceive, must be extended *absolutely without limit*, if it be not terminated by our view of *some* SECOND color.

SECOND LAW.—FORMATIVE.

Prop. When any two unblended (i. e. *unsoftened*) sensations of colors are felt at the same time, they MUST MEET *by their nearest edges*, and this MEETING we must perceive as A LINE.

Inst. If the eye traverse either the firmament, or the ocean, until it arrive at, *and take in*, ANY SECOND color; the evidence we have for this fact can be no other than *our being conscious* WHERE ONE sensation of COLOR ENDS, *because the* OTHER BEGINS. This MEETING of the two sensations of colors, is A LINE of CONTRAST and of CONTIGUITY *in our view*: and a perceived line, therefore, is purely nothing but A THOUGHT OF DISCRIMINATION, which we make between two of our own sensations. At the same time it must be evident, upon reflection, that we can *no more avoid perceiving the* CONTRAST, *and the* EXTENDED DIRECTION OF THIS CONTRAST, than we can avoid being conscious of the *two different sensations of colors which form this contrast*.

THIRD LAW.—FORMATIVE.

Prop. When any two unblended sensations of colors are felt at the same time, and are so disposed as that one of them *embraces or surrounds* the other, we must perceive a line of junction, which is where the embraced sensation meets that which embraces it. Such a line must *return into itself*; and thus is formed *every complete figure* that the visive faculty can *strictly apprehend*.

Inst. When we look at the Moon, surrounded by the azure sky, we suffer a SENSATION OF SILVER WHITE, *embraced by* A SENSATION OF AZURE, and the line perceived between these two sensations *returns circularly into itself*; which people *take* for the circle of the Moon.

It must be an obvious truth here (although it is overlooked by PROCLUS) that, *WHATEVER be the* HUES OR TINTS *of the two sensations employed*, there can be but ONE UNIVERSAL PRINCIPLE that gives any perception of a LINE BETWEEN *them*; and this principle is A PERCEPTION OF CONTRAST.

FOURTH LAW.—UNFORMATIVE.

Prop. When any two sensations of colors are felt at once, and are *blended or softened* at their nearest edges, they never can be per-

ceived as forming *any* LINE between them, not even if their distant parts be of the most opposite colors.

Inst. Let any surface be conceived to be *black* all round its edge, and *white* in its centre, and let the two colors run gradually into each other : No line can ever be perceived from looking within the field of this surface.

Innumerable other instances of this fact may be observed ; such as when we look at waving corn, or shot silks, spheres, mirrors, or drinking glasses.

This Fourth Law strikingly illustrates the other three ; because herein we suffer *TWO sensations of colors with A NEGATION of all FIGURE, OR LINE, between them ;* and here, therefore, we are, *by a NEW RESULT, more vividly* (though not more certainly) *convinced* that it is *NOT COLOR, BUT CONTRAST, that is the CREATIVE PRINCIPLE of any perceived VISIBLE FIGURE, OR LINE.*

To conclude. Visible figure is a *POSITIVE thing to OUR VIEW, but only a RELATIVE thing* in regard to the *TWO SENSATIONS OF COLORS* which combine to give it being : it is nothing but the *CO-LOCAL OR CO-EXTENDED RELATION* of one sensation to the other. —To say, therefore, that we perceive visible figure, is to say that we perceive the *co-local or co-extended relation* which one sensation of color bears to another one, felt at the same time.

It follows, upon the highest KIND of evidence, that visible FIGURE is nothing but A CREATURE OF THE PERCIPIENT,—A THOUGHT OF THE MIND,—(yet, we must infer) a thought resulting from the action of SOME EXTERNAL CAUSE, stimulating our visive constitution.

THE LAWS of VISION are MATHEMATICAL AXIOMS.

The four General Facts of Vision are herein called only *Laws*, because their subjects are, in the first place, sensible or natural phenomena. But it must be insisted upon that they possess a far higher title, in being *MATHEMATICAL AXIOMS.*

What renders this consideration most important, is, that even could it be proved that visible lines are not mathematical as to the property of being *void of breadth*, this (as has been already remarked) would not hinder the Laws of Vision from being *Mathematical AXIOMS in THE CLASS of their evidence, the SELF-EVIDENT NECESSITY of their truth.*

Physical laws (it is agreed on all sides) *are not necessary, in our conception :* they rule what is ; but, may not rule what *SHALL BE :* Light may fail to excite sensations of colors in the human mind ; and sensations of colors may, *for aught we know,* be excited in minds without eyes : all this is *conceivably* possible. But, to conceive *any ONE sensation of color with a boundary or LINE to it ;*

Or, to conceive any TWO *unsoftened sensations of colors at once* WITHOUT A LINE *between them*, is an impossibility of the *very SAME CLASS*, as to conceive an infinite surface with a limit, or TWO contiguous mathematical surfaces without the line that *makes them TWO*.

Now this PERCEIVED NECESSITY of the Laws of Vision, is, I must insist, a paramount test that a visible line is not an external thing; because, it is *not merely an object of SENSE, but is an object of INTUITION*; and it is not merely a thing that now is, but a thing that *EVER MUST BE, if its CO-EFFICIENTS exist*. Every EXTERNAL object is a thing that *may not be* at any future time: and, while it exists, we *know not its co-efficients*: but, we *absolutely know the co-efficients of a visible line* by the same process of RATIONALITY, and to the same PERFECTION, that we know that *the co-efficients of ANY IDEA OF RELATION must be SOME TWO THINGS, BETWEEN WHICH the mind perceives this relation*. Here I must refer to the small tract I published some time ago upon "NECESSARY CONNEXION;" in which my object is to show that we *absolutely know the CO-EFFICIENTS of ALL OUR IDEAS OF RELATION*; and in which I suppose the thing is rigidly proved. Now, SENSATIONS OF COLORS ARE IDEAS; and I repeat it here, that we have the *same degree of cognizance of THEIR RELATIONS* (one to another) that we have of the *relations of equal, double, or half*, between any two mathematical quantities; that is, we *perceive the NECESSITY OF THE RELATION, so long as the two SUBJECTS ideally exist*; and we intuitively perceive that the *relation cannot exist unless its two subjects ideally exist*.

If this matter stand the test, what a change *is thus produced* in the *assumptions and scope of mathematics*, to find, that its conclusions are *NOT limited to hypothetical or conditional truth*, but embrace also FACTS, and CONCRETE EXISTENCES! *What an enlargement of the field of demonstrable subjects!* And how curious, thus to find a community of subjects between two sciences hitherto considered, in their very essences, incompatible!

VISIBLE LINES ARE VOID OF BREADTH.

This general fact (it is always to be remembered) is *wholly subordinate* to the Laws of Vision, being *included* in those laws, but not necessary to their truth. At the same time, however, it is a fact rigidly demonstrable.

A mathematical line (*of the SCHOOLS*) is *demonstrated* to be void of breadth, in consequence of its being *defined* to be "*the common boundary of two contiguous surfaces*." Now, if one of the two surfaces be conceived by us to be *blue*, and the other one *yellow*, it is

plain the *mathematical line of contiguity*, and the *line of contrast of the two sensations of colors*, is ONE SAME LINE; and since this line has no breadth as the *common boundary* between the two *surfaces*, it can have no breadth as the *common boundary* between the two *sensations of colors*.

To attempt to invalidate this upon the ground of the *imperfection of sense*, would only prove that the person who undertakes it does not apprehend ALL the terms of the subject. The subject is A LINE that WE SEE: And, (without any appeal to the suffrage of PROCLUS) I may safely maintain that we DON'T SEE what we DON'T SEE. The imperfection of sense only makes us NOT SEE *breadth*, in some instances where breadth really is before us, and where a magnifying power makes it evident: But the imperfection of sense cannot make us see *breadth* when it makes us NOT SEE it. In rigid truth, therefore, the IMPERFECTION of the organic process of sense, causes the PERFECTION of the *mathematical line we SEE*; for the organ will not convey a report of breadth to the SENTIENT, in some cases wherein the EXTERNAL object that we look at really has some minute breadth.

A visible line cannot be of any one color; because it is proved (by the First Law) that no one color ever can have a line. If then a visible line have any color, it must be a part of each of two contiguous colors: but this would show a DOUBLE OUT-LINE to every object, which we know to be a result utterly contradicted by the fact.—Moreover, if any such double or two colored lines be supposed, it is plain that each one is but a rim of its own SURFACE; and what is SURFACE cannot be LINE; neither can two contiguous sensations of colors APPEAR to us as forming a LINE until we mark the PLACE where BOTH COLORS CEASE TO BE, by reason of their coming in CONTACT.

It is true, I readily grant, that we see instances enough of breadth in what are called *softened lines*, or where two colors blend: But none of these things are visible lines; they are all visible SURFACES, and they must be stript of the appellation of LINES, in an inquiry like the present.—Visible lines I consider to be, all those lines which are void of breadth to the NAKED EYE, and which can farther attest that they are breadthless to the naked eye, by showing no breadth when subjected to a MAGNIFYING POWER.—Such lines, the reader will find, are raised in our sentient by our looking at the edges of the letters of good printing, as divided from the white field of the paper: and such lines, too, are seen when we are looking at most other objects.

It must be an obvious truth, that a visible line which shows no breadth under a magnifying power, can have no breadth to the NAKED EYE. It is therefore vain to try to overturn the fact, even if

we could by the strongest power produce any evidence of breadth : for it must still remain, that the NATURAL EYE of man enables him to see NO LINES, *but lines that are VOID OF BREADTH IN HIS APPREHENSION OF THEM.*

Finally ; But if, in the face of experiment and of common sense, any person choose to assert that A VISIBLE LINE HAS INVISIBLE BREADTH ; then, (I must repeat it here) this *absurd contradiction in terms*, if suffered to stand for an objection, could be of no concern to the LAWS OF VISION ; for these Laws must still be AXIOMS, and a VISIBLE LINE *must still be nothing but A LINE OF CONTRAST BETWEEN TWO SENSATIONS* : And the CONTRAST LINE *must still, and for ever, be where the SENSATIONS ARE which form it, which is IN THE MIND ITSELF*

HEREUPON, I make the appeal, in this one question,—Will it (*against the FOUR AXIOMS OF VISION*) be ever affirmed, that VISIBLE FIGURES *are the* DISTANT THINGS OF AN EXTERNAL WORLD ? Or, will it be ever affirmed that *Visible Figure* is not a phenomenon of the mind ?

The "MONTHLY REVIEW," for March last, having done me the honor to take up the foregoing subject (under the Title of "*Principles of Primary Vision*," as published by me in 1815), it has become very material to its advancement, that I should embrace the earliest opportunity, even at the disadvantage of a very short notice, to explain some points which have appeared to demand illustration.

First, however, I must offer my testimony of this Reviewer having gone into the subject, and having delivered his own opinion thereupon, in a way which bespeaks his having felt himself in the discharge of a serious responsibility. Having apprehended, and concisely stated, (as he has done) the *radical principle* of the "*Laws of Vision* ;" certainly, he could not have given greater force to their claim, than by also setting before his readers that *self-refutation* into which, I have shewn, Dr. Reid fell.

The subject is, by this Review and other Publications, placed in a light under which, I have at length the satisfaction to know, it cannot be overlooked : The matter is now in the eye of the public : it must therefore be either *done away* by some objections which can meet the expectation ; or else, a consequent inference must be drawn.

It remains now due to the matter in question and to myself, that I should speak to the "*well-meant hint*" of a Critic who has taken such high ground between the public and the subject.

It may be supposed I was struck by a hint, coming from a quarter which has thus commanded my respect, to "*avoid the appearance of quackery and puffing, which must attach, however unjustly, to such titles as those we allude to.*" Nevertheless, when I was roused to this view of the thing, I quickly perceived that such an unworthy and unreal appearance must indeed attach to it, in the eyes of every man of science who is hitherto a stranger to the peculiar nature of the subject: And perhaps many persons might not add the candid conclusion, that any charge upon this ground would be made "*unjustly.*" In this case, therefore, I trust that it will not be unacceptable to my honorable and manly chastiser, when I avow that I have no such thought as that of an apology; nor could I feel here satisfied in offering a mere justification; because I shall put in a plea of logical necessity, if not of some small claim on the score of first discovering the just distinctions which (on one hand) separate my subject from all the subjects of physical evidence. The title of "*Paramount Proof*" was the head given by me, to that supplementary Section, wherein I originally started the principle of the "*Laws of Vision.*" Since then I republished the "*Principles of Vision,*" in a more regular form; and therein I deemed it necessary to call these principles by the full title of "*A Demonstration.*" Lastly, In my "*Letter to Professor Stewart,*" it has since appeared that I suppose the nature of the phenomena rigidly to demand the title of "*The Axiomatical Laws of Vision.*" Now, it appears very important to the advancement of the subject, that the attention of the public should be awakened to the real and whole nature of the thing: and it is therefore perhaps fortunate that the exception to "*appearances,*" very fairly taken at my "*Titles,*" has furnished me an occasion for defending them.

First, to render justice to my Critic, I willingly advert to the two following considerations, namely, The *Phenomena of Vision* have always been held to be merely physical appearances, contingent in their existence, and but experimental in their evidence: Upon the other hand, the terms "*Axiom*" and "*Demonstration*" are restricted in philosophy, to necessary relations between our ideas. Certainly therefore, when any man of science is presented with the title of "*A Demonstration*" prefixed to what he supposes only a speculation in physics, he must be disgusted: and this seems to have been the effect on the *Reviewer*. The following remarks, it is to be hoped, will completely remove, or prevent, any such feeling of the matter in future.

1st. The *Phenomena of Vision* consist of two very different classes of objects, namely, Of SENSATIONS of colors, and of RELATIONS (lines) perceived between these sensations. The sensations of colors, themselves, are merely contingent ideal existences, which either

may, or may never, exist : But, *everytime* that ANY TWO of them exist together (*unsoftened*) it is (I say) a *necessary law of thought* that we *must* perceive the RELATION called a *line* between them.

Precisely with equal truth to the above, all the principles in *Geometry* are *only mere contingent ideas*, which may, or may never, exist in any mind : But, every time that the ideas of any two *triangles* equal to a *third*, are called up in our mind, we *must* perceive a *relation* between the *first two*, which is the relation of *equality*.

In other words, I maintain that *Euclid's Elements*, and the *Laws of Vision*, are *each alike* made up of TWO CLASSES of thoughts : One of which classes contains *only contingent ideas* ; The other class *necessary relations* between those contingent ideas.

2dly. A *mathematical Axiom* is a *simple Theorem*, expressing an *eternal relation* between any two substantive ideas. Now each of the "FOUR LAWS OF VISION" is *such a Theorem* : The second law, for instance, affirms that a *LINE* is a *necessary relation* between any two unsoftened sensations of colors ; And our understanding discerns the *self-evident impossibility of its ever being otherwise*.

From this very partial illustration, the discerning Critic will doubtless perceive, that the thing I am respectfully offering for consideration, if it be found to be any thing at all, or that men in general shall join with my ingenuous Critic, and others, in openly confessing that they "*cannot detect its fallacy* ;" it must then be quite foreign to its highest nature, to call it *either* "*an hypothesis*," or yet a *physical subject* : because, on the contrary, it *must* take its place, *absolutely in mathematical science*.

To prevent being possibly misunderstood here, I must reiterate the following distinctions ; namely, *Sensations of colors* must ever be a *PHYSICAL SUBJECT* ; their existence is contingent, and their *evidence* is *EXPERIMENTAL*.—*VISIBLE LINES* must ever be a *MATHEMATICAL SUBJECT* ; *their nature is necessary*, and their *evidence* is *DEMONSTRATIVE* !

It must now, I hope, appear, that in *order to treat my subject at all*, it was *imperative* upon me to assign to the Principles of Vision, the *mathematical terms* and "*Titles*" which *I have* done. In a word, it was my being struck with the *mathematical character* of ONE CLASS of the phenomena of Vision, that *alone* led me to the change which I hope is effected in the subject. BISHOP BERKELEY had bent his great acumen upon *sensations of colors* in their *physical character*, that is as *ideas in relation to ourselves* ; But he failed in throwing any light on the PROBLEM OF PERCEPTION, solely because he never happened to be struck by the *mathematical relations* which our ideas of colors have *between EACH OTHER*.

One word remains to be added, as to my "*style*." Upon the ground of its "*awkwardness*" I do, with great humility, abandon this

matter to the censure of the Reviewer. But I hope my above remarks will lead him to suppose, that I *could* defend my "*philosophical language*," in many instances wherein, *from the nature of the subject*, it may appear very exceptionable. His strictures thereupon, I nevertheless receive with great respect, and a desire to keep them in view : Sincerity and candour are eminently manifest in them ; and I court the continuance of such correction.

In the *first* impression of the foregoing letter, I omitted to remark, that any supposition of visible lines *HAVING breadth* (although refuted above, and although if tenable it would be of *no consequence to the "LAWS OF VISION,"*) is however a supposition that *could only* embrace all those Visible Lines occasioned by our looking at colors *spread upon one same continuous surface*, such as the objects on a Painting, or a Writing. ALL OTHER visible lines (*which are infinitely the more ordinary and more numerous objects*) defy every pretence to suppose that they have any *visible* breadth ; because, it is manifest, for instance, that the *color* of my hand, when I hold it up to the light, *cannot run into* the *color* of the sky which does not touch my hand by several miles ; and therefore such lines *can have no breadth in themselves* ; far less, then, can we *see* in them what they have *not*.

This *last kind* of lines is what I gave for *Examples*, in the original broaching of the subject : and it was quite *gratuitous* my choosing to defend, as I *still do*, the *first kind*, also.

